LOW COST NUCLEAR THERMAL ROCKET CERMET FUEL ELEMENT ENVIRONMENT TESTING

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ABSTRACT

Deep space missions with large payloads require high specific impulse (Isp) and relatively high thrust in order to achieve mission goals in reasonable time frames. Conventional, storable propellants produce average Isp. Nuclear thermal rockets (NTR) capable of high Isp thrust have been proposed. NTR employs heat produced by fission reaction to heat and therefore accelerate hydrogen which is then forced through a rocket nozzle providing thrust. Fuel element temperatures are very high (up to 3000K) and hydrogen is highly reactive with most materials at high temperatures. Data covering the effects of high temperature hydrogen exposure on fuel elements is limited. The primary concern is the mechanical failure of fuel elements which employ high-melting-point metals, ceramics or a combination (cermet) as a structural matrix into which the nuclear fuel is distributed. It is not necessary to include fissile material in test samples intended to explore high temperature hydrogen exposure of the structural support matrices. A small-scale test bed designed to heat fuel element samples via non-contact RF heating and expose samples to hydrogen is being developed to assist in optimal material and manufacturing process selection without employing fissile material. This paper details the test bed design and results of testing conducted to date.

Keywords: NTR, fuel element design, cermet